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THE WATER SUPPLY OF THE QUAD CITIES¹

BY MARTIN R. CARLSON²

The Quad Cities (Davenport, Iowa, Rock Island, Moline and East Moline, Illinois), offer to the water works man a good field for observation. In our midst we have six distinct water departments—four supplying filtered Mississippi River water and two well water. Three of the four use mechanical filters and the fourth pressure filters. In East Moline, Illinois, and Bettendorf, Iowa, they use deep-well water, pumped into elevated tanks.

Davenport. Unlike the Moline, Rock Island, East Moline and Bettendorf plants, the Davenport water works is owned by a private corporation operating under a franchise. The source of supply is the Mississippi River the intake being located on the north side of the main channel. The method of operation is by gravity from river to screen chamber and intake well; pumping from intake well to settling basin; pumping from settling basin through filters to low-service mains and elevated storage reservoir; pumping from storage reservoir into high-service mains. The water supplied to the low-service mains is pumped twice; the water supplied to the high-service mains is pumped three times. The total quantity is about 4,000,000 gallons per day, of which about 1,500,000 gallons are pumped into the high service mains.

The works were built in 1873 and have been under the same management since that time. The main idea in the mind of the management has been "service first." This is shown in many ways. For instance, filters were installed in 1891, which was early in the history of mechanical filters, and modern improvements such as large sedimentation basins, air wash and sterilization have been added as soon as shown to be practicable. Then there is the great advantage of two pumping stations in time of large fires, the reservoir pumping station supplying water down hill for fires in mercan-

¹Read before a joint meeting of the Iowa and Illinois Sections on October 11, 1916, Moline, Ill.

²Mayor of Moline.

tile and manufacturing districts to assist the main pumping station and reduce the rate of filtration. All hydrant branches have auxiliary gate valves. More than 22 per cent of the mains in the distribution system are 12 inches in diameter and larger. The mains less than 6 inches diameter are between 3 and 4 per cent of the total mileage. There are 100 miles of mains and 975 public fire hydrants.

The last franchise was granted in 1913 and extends for twenty-five years from January 1, 1914. It provides for proper regulation, character of fire streams, elimination of 4-inch mains, location or relocation of fire hydrants, appraisal of property, option to purchase, testing of meters, rates, annual statement of books and accounts, payment of taxes, character of water and service, and a large amount of specified new construction to be completed in three years. Before granting a franchise a special election was called to decide if the voters desired to buy or to build a water works. The voters did not, and then the franchise was submitted to the voters and adopted.

Extensions of mains are made by order of the city council, when there is an average of three consumers to each 400 feet of main, the city council ordering at least nine hydrants per mile of extension. All the expense of extensions of mains is borne by the water company, of course.

Because of the unusual facilities of both the water and fire departments for fighting fire in Davenport, the underwriters have placed the city in Class 2 for rating purposes. Davenport had 9360 water consumers on January 1, 1916, of which number 7225, or 77 per cent, were metered. The daily pumpage per capita is 80 gallons.

Since the new franchise was granted the company has laid 15 miles of new distributing mains, laid a 24-inch force main from the river pumping station to the business district; rebuilt its river pumping station and installed there a new 10,000,000 gallon, triple-expansion, vertical, crank-and-flywheel, high-duty pumping engine, two additional 250-horse power water tube boilers and stokers. A new 5,000,000-gallon, turbine-driven, centrifugal pump has been placed in the reservoir station.

The Davenport reservoir is located 150 feet above the business district, producing about 65 pounds pressure. This is the average pressure for domestic purposes on the low service mains. The reservoir pumping station stands on ground as high as any in the city

and 40 pounds pressure is carried on the pumps for domestic purposes. This gives from 40 to 100 pounds, on the high-service mains, which cover all levels between that of the business district and that of the reservoir.

When there is a fire on the low-service, a valve on the pipe connecting the low-service mains with the reservoir is closed by the employees at the reservoir. The river pumping station then pumps directly into the low-service mains, carrying about 90 pounds pressure in the business district and 100 pounds at the pumping station. In case it is desirable, some water may be pumped from the reservoir by the reservoir pumping station into the low-service mains, there being a valve for this purpose in the reservoir pumping station.

In case of fire on the high service, the speed of the pumps at the reservoir is increased to maintain 70 pounds pressure at the pumps, producing from 70 to 130 pounds at the hydrant, according to location. Both pumping stations are operated continuously by three crews, each working eight hours.

The original works consisted of 20 miles of mains, a twin-cylinder horizontal engine geared to a long-stroke, slow-moving, horizontal pump, which lifted water from the river and pumped into the mains. The engine, as well as many of the valves, hydrants and special castings, were built by the late Michael Donahue, of Davenport, who obtained the original franchise to build the water works. Mr. Donahue's son, Colonel James P. Donahue, is today secretary and treasurer of the company. Thos. N. Hooper was associated with Mr. Donahue from the beginning of construction and is still vice-president of the company.

Rock Island. In Rock Island the water is taken from the main channel of the Mississippi river through two intake pipes, a 20 and a 30-inch, and flows into a well at the pumping station, which is 2100 feet from the channel. It is then pumped through a 16-inch main to the settling basins, $1\frac{1}{4}$ miles distant and 175 feet above city datum, and flows from the settling basins to the filters; thence from the filters to the clear-water basins and reservoir. From the reservoir, it is conducted to the city level through a 20-inch main, under 55 to 60 pounds pressure. There is a 500,000-gallon standpipe at the reservoir, the balcony of which is 125 feet above the ground. This is used for the bluff service or high line. The pump to supply the standpipe is installed at the filter plant, and is electrically driven.

When the water works was first installed in 1874, direct pressure was used, and this was continued until 1900. In the fall of 1897 the city began two settling basins, three slow sand filters of 1,000,000 gallons capacity each, and a reservoir of 8,000,000 gallons capacity. This improvement was completed in 1900, and since that time the supply has been by gravity from the reservoir. In 1910 it became necessary to enlarge the filtering capacity and the area required was so great for the slow sand filters that mechanical filters were adopted. They now have a plant with a capacity of 6,000,000 gallons in twenty-four hours installed in one of the old slow sand filters, and the two other filters are used for clear-water basins, and, with the reservoirs proper, altogether hold about 12,000,000 gallons of filtered water. The two settling basins, of 2,500,000 gallons each, are still used for that purpose.

The coagulant is applied to the raw water at the inlet to the basins and is given a period of six to twelve hours. After passing through the basins, the treated water is conducted to the filters in a 36-inch conduit, into which liquid chlorine is applied about 25 feet before entering the filters. There are six filters of 1,000,000 gallons capacity.

At the present time there are about 65 miles of mains in Rock Island, but a contract has recently been let for 6 miles more to be laid this year. Most of this work is necessary to supply a newly annexed territory to the south, and includes a 1,000,000-gallon stand-pipe for high pressure, to be placed about 125 feet above the ground. An electrically driven pump will be used to fill this tank.

There are about 600 fire hydrants, and the department is making a practice of placing a hydrant on each corner of each block and placing a gate valve on the branch to each hydrant. This is a recognized improvement in hydrant installation, as repairs to the hydrant can be made without shutting off the main. All new hydrants have an outlet for steamer nozzle and two outlets for a 2½-inch nozzle. Another commendable practice is that of laying large mains about every five blocks and cross-connecting them with not less than 6-inch mains.

Rock Island has about 6000 water consumers, with a revenue of about \$73,000 annually. All schools, the Y. M. C. A., and hospitals and charitable institutions are given water free of charge. The meter rate is from 20 to 6 cents for each 100 cubic feet, with a minimum charge of \$9. The minimum flat rate for residences is \$9.

Government Arsenal. On the Arsenal Island, there are medium size settling basins and gravity filters, very similar to the Moline plant.

Moline. In the city of Moline are found small settling basins and gravity filters. Alum is used as a coagulant and chlorine for sterilization. Prior to 1883 water was supplied to Moline by pumps in one of the local saw mills. During this year some enterprising citizens undertook the building of a private water company on the present location. The water was taken from the river and supplied to the citizens in its raw condition. In 1885 an agreement was reached with the water company for the taking over of the equipment by the city, and for thirty-one years Moline has been supplied with water by its own plant. From 1885 to 1903, raw Mississippi River water was in use. In 1903 mechanical filters were installed. At that time three 1,000,000-gallon units were placed in operation and since then two more have been added, giving Moline a filtration capacity of 5,000,000 gallons. The settling basins are very small, holding about 500,000 gallons, so baffled, however, that only a very small part is dead space. The clear-water reservoir holds 750,000 gallons. In conjunction with this a standpipe on the hill has recently been installed having a capacity of 500,000 gallons, making the filtered water storage 1,250,000 gallons.

The low-service equipment consists of centrifugal pumps, one 5,000,000-gallon and one 6,000,000-gallon, one unit being driven by a Kerr turbine and the other by either a water motor connected to the high-service pump or a high speed engine. Two intake pipes are used, one taking water from a slough to the rear of the plant, and the other taking water from the main channel.

The high-service equipment consists of a 10,000,000-gallon Epping-Carpenter pump, a 6,000,000 Holly-Gaskell, and a 5,000,000-gallon Deane, giving a total high-service capacity of 21,000,000 gallons. Venturi meters have been installed for determining the city consumption and boiler feed water consumption.

In 1911 a question arose as to the advisability of extending the raw water intake pipe 6 or 7 miles upstream so as to obtain a purer supply. Upon the recommendation of the Illinois State Water Survey, the project was dismissed and more important improvements at the water plant adopted. On the recommendation of a consulting engineer \$164,000 in bonds were issued for the rehabilitation of the water works and distribution system. The improvements completed from this issue consist of new boiler equipment, new

stack, new pumps, new building, elevated tank, new mains and meters. These improvements were finally completed in 1915.

It is the plan of the water department to have every service in the city metered. At the present time about 1700 meters, or about one-third of the total services, have been installed. The total city consumption ranges from 3,500,000 to 5,000,000 gallons daily. For a city of 30,000 population we have about 5700 services and 68 miles of water mains.